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ABSTRACT

The program planning guide for forestry was written to assist Applied Biological and Agricultural Occupations (ABAO) teachers in enriching existing programs and/or to provide the basis for expansion of offerings to include additional materials for the cluster areas of forests, forest protection, logging, wood utilization, recreation, and special Products. Each guide includes the following components: an introduction (brief discussion of the subject matter); sample job titles and cluster areas (major job titles, D.O.T. numbers, O.E. numbers, and information about salaries, educational requirements, and career advancement opportunities); competencies for cluster areas and for job titles, stated as behavioral objectives; a core course outline (a representative sample of how a curriculum should be constructed, including references); sample teaching plans designed for one to five days in length (comprising cluster areas, unit titles, problem areas, a brief introduction, student performance objectives, a detailed outline of instructional content, learning activities, special materials and equipment and student references). Also included are: specific and selected references; a brief description of school facilities; lists of equipment, supplies, and audiovisual materials; and a partial list of ways to increase teacher competencies. (BP)

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Volume VII

# PROGRAM PLANNING GUIDE IN FORESTRY

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Development of Teachers' Guide and Students' Instructional Materials for Seven Selected Applied Biological and Agricultural Occupation Related Areas (PCB-A5-031)

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# INTRODUCTION

The Program Planning Guides were written to assist the Applied Biological and Agricultural Occupations teacher in enriching the existing programs and/or to provide the basis for expansion of offerings to include an additional agricultural cluster area. For example, the current offering may be Agricultural Production with Agricultural Mechanics, and Agricultural Supplies and Services is to be added to the offering.

These guides are the result of a funded project coordinated by the Professional and Curriculum Development Unit, Division of Vocational and Technical Education, Board of Vocational Education and Rehabilitation in cooperation with the Agricultural Industries Department, Southern Illinois University, Carbondale, during the FY 1975. The project was entitled "Development of Teachers' Guide and Student Instructional Materials for Seven Selected ABAO (Applied Biological and Agricultural Occupations) Related Areas." The seven ABAO areas selected include:

1. Agricultural Production - O.E. Code 01.0100
2. Agricultural Supplies and Services - O.E. Code 01.0200
3. Agricultural Mechanics - O.E. Code 01.0300

4. Agricultural Products - O.E. Code 01.0400
5. Ornamental Horticulture - O.E. Code 01.0500
6. Agricultural Resources - O.E. Code 01.0600
7. Forestry - O.E. Code 01.0700

Major division, cluster area, and job titles were written with O.E. numbers, and only an occasional reference to D.O.T. The O.E. code was selected because teachers in Illinois classify all of their students under this system.

The provisions of the SIU/C-DVTE project provided an opportunity for participation from throughout the Illinois Applied Biological and Agricultural Occupations staff. Each member contributed in his unique way, and they represent each of the four institutions which train DVTE staff, V.A.S., and ABAO teachers in community colleges and high schools.

The projects activities were coordinated by a Steering Committee. All major decisions on content, format, job titles, and final draft approval were the responsibility of the steering committee. They spent considerable time and effort in reviewing these guides. The steering committee was composed of the following members:

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Each guide includes the following component parts.

Introduction Unique consideration for the subject matter area.

Sample Job Titles and Cluster Areas This includes information about salary, education requirements and career advancement opportunities. These job titles and cluster areas are coordinated with a brochure entitled "Applied Biological and Agricultural Occupations Career Directory" published by the Division of Vocational and Technical Education, 1035 Outer Park Drive, Springfield, IL.

Competencies for Cluster Areas and Competencies for Job Titles The competencies, stated in measurable terms, are presented by cluster areas and job titles.

Core Course Outline The core course outline is a representative sample of how a curriculum could be constructed to present the program.

Exemplary Teaching Plans This is a section which incorporates teaching plans for selected units in the outline. Their function is to provide sample plans which the ABAO teacher may follow in developing his respective units.

Reference The references are coded into the teaching plan and listed with their source in the reference section.

School Facilities, Equipment, and Supplies This provides the ABAO teacher with a source for major items which will be required to operate the program.

Audio Visual Materials This is a listing of currently available visual materials for use in teaching the respective subject matter areas.

Teachers Competencies and Training Available This is a brief review of sources where the teacher could secure additional skills to assist in delivering a quality program.

These Program Planning Guides were prepared to improve the quality and increase the scope of Applied Biological and Agricultural Occupations offerings available in Illinois. The Guides can only be successful with your review, adaption, adoption, and implementation.

## INTRODUCTION TO FORESTRY

This guide is concerned with planning an instructional and an experience program for high school students which will permit the students to gain job entrance competencies to those forestry jobs for which a high school education is adequate. Many forestry jobs are professional in nature and the college undergraduate degree is the minimum educational requirement. Many other forestry jobs require a high school diploma and one-half to two years of additional educational training and/or field experience. For high school students who aspire to these professional roles, the high school vocational program in forestry would serve as occupational exploration, motivation, and as pre-professional training.

When compared with other areas of agriculture, forestry does not employ large numbers of persons in Illinois. One publication[1], using 1970 census data, reports that in Illinois, among eighteen occupations that require or utilize agribusiness competencies in any industry where hired, there were seven hundred fifty-nine persons employed as foresters and conservationists, among 133,710 persons employed in the

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[1] Employment in Agricultural and Agribusiness Occupations, Region 5, Economic Research Service, USDA, Washington, D.C., Oct. 1974, pp. 14-24.

eighteen occupations. In the same publication in the section that reports on occupations within Illinois which require or utilize agribusiness competencies only in selected industries, among the 20,453 employees in fifty-four such occupations, 506 were sawyers in logging or sawmill industries, 397 were lumbermen, raftsmen and woodchoppers, 33 were teamsters in the sawmill industries, and 98 were miscellaneous laborers in forestry, a total of 1,034. The above figures do not include any of those employees who were included in the gardener and groundskeeper occupation. The fact that many of them (1617) were employed by federal, state and local public administrators, which would include forest lands, nurseries, parks, campgrounds, etc., indicates that they require competencies in forestry in their respective occupation.

Even though the number of forestry employees is not large in Illinois, forestry occupations exist in all regions of the state. Also, many individuals with forestry training hold jobs where their expertise enables them to handle assignments in forestry related activities but where they may not be classified as "foresters" per se. The extensive national, state and local parks, the forested areas in localities of rough terrain, in river bottoms, and in areas of land reclamation are all sites or potential sites of employment in forestry occupations. Every county in Illinois, except Cook County, has commercial forest lands, the acreage ranging from less than 5,000 in Boone County to over 100,000 in Jackson County.[2]

[2]Directory of Sawmills and Other Wood-Using Plants in Illinois, Dept. of Conservation, Division of Forestry, Bulletin, (1969).

Cook County does have though forested acreage in the Cook County Forest Preserve District. Each teacher of Applied Biological and Agricultural Occupations, who is contemplating including forestry occupations in his vocational program, must assess his local situation to determine entry into forestry job opportunities in his school's employment area.

This document is titled a Program Planning Guide and should be used as such--a guide or pattern to be followed while planning and developing an instructional and supervised experience program in forestry to fit the needs of students in a particular school system. It is not intended to be a definitive course outline, complete lesson plans, and cookbook procedure for teaching a vocational program to prepare students for employment in non-professional forestry occupations.

## SAMPLE CLUSTER AREAS AND JOB TITLES

The cluster areas and job titles included in this guide are:

Forests

- Forester Aide

Forest Protection

- Fire Patrolman

Logging

- Faller
- Cordwood Cutter

Wood Utilization

- Sawmill Worker

Recreation

- Park Worker

Special Products

- Nursery Worker
- Tree Planter
- Tree Pruner

Forestry is included as one of eight career areas in Agriculture as classified by the Office of Education, U.S. Department of Health, Education and Welfare. Within this classification system the area of forestry is assigned the numerical code 01.07 00 00 00 and has this definition:

"01.07 00 00 00 Forestry (Production, Processing, Management, Marketing and Services)--A combination of subject matter and experiences concerned with the multiple use of forest lands and resources, including their management and protection."[1]

The same document of Standard Terminology has six specific sub-headings defined under forestry plus the general classification "other forestry", and, of course, the coding system provides for other sub-sections to be added and coded as a need arises. The sub-headings under forestry, their code numbers and definitions are:

"01.07 01 00 00 Forests--A combination of subject matter and experiences concerned with forests as living communities of plants and animals in which trees are the dominant species. Emphasis is on the multiple use of forest lands and resources."

"01.07 02 00 00 Forest Protection--A combination of subject matter and activities designed to provide knowledge, understanding, and judgement concerning the behavior of enemies of the forest and their control."

"01.07 03 00 00 Logging (harvesting and transporting)--Study including observation and practical experiences, concerned with the initial collective activities involved in harvesting trees as a crop and in terms of not interfering with other desirable uses of the forest."

"01.07 04 00 00 Wood Utilization--Organized subject matter and practical activities concerned with the many wood products of the forest. Emphasis in instruction is on the study of production, selection, grading, and marketing of forest raw material (wood) for multiple uses in conversion to consumer

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[1]Putnam, John F. and W. Dale Chrisman, editors: Standard Terminology for Instructors in State and Local School Systems, U.S. Dept. of Health Education and Welfare, p. 376.

goods, e.g., paper, plywood, wallboard, plastics, and preservative-treated wood products."

"01.07 05 00 00 Recreation--The study of recreation as one of the multiple uses of a forest, including emphasis of the principles of conservation. Included in instruction are examples of recreation activities which can be established, maintained, and managed, such as fishing, picnicking, hunting, camping, and nature study."

"01.07 06 00 00 Special Products--Organized subject matter concerned with the production and marketing of special products, e.g., maple syrup, nuts, Christmas trees, and other products. Consideration is given to the great variety of products utilized in their natural states and/or manufactured from such products. The following are representative of special products."

"01.07 06 01 00 Christmas Trees"

"01.07 06 02 00 Maple Syrup"

"01.07 06 03 00 Nuts"

"01.07 06 99 00 Other Special Products--Include here other special products emphasized in instruction which are not listed above. (Specify.)"

"01.07 99 00 00 Other Forestry--Include here other organized subject matter and activities emphasized in forestry which are not listed above. (Specify.)"

"20.01 11 00 00 Future Farmers of America--U.S. Office of Education, Washington D.C."

Many forestry occupations can be performed adequately only by the professional forester. This Planning Guide is concerned with developing a high school vocational education program in forestry to train for job entry upon completion of high school. Typical forestry jobs for which high school education is adequate preparation for job entry include:

| Title | D.O.T. No. | |
|---|---|---|
| Forester Aide | 441.384 | |
| Fire Patrolman | 441.687 | |
| Faller | 940.884 | |
| Cordwood Cutter | 940.884 | |
| Sawmill Worker | 667.782 | |
| Park Worker | 407.887 | |
| Nursery Worker | 406.887 | |
| Tree Planter | 441.887 | |
| Tree Pruner | 441.887 | (also Agric. 404.884) |

## SAMPLE JOB DESCRIPTIONS

Persons employed in forestry occupations often find that they must be able to perform several varying tasks or assignments. This makes specific description or definition of a forest worker's duties more difficult. In practice however, the diversity of activities performed by the forest worker makes his job more interesting and challenging. Because the forest worker must be versatile, it also enhances the opportunity for advancement wherever and whenever a position opening occurs.

In this section on sample job descriptions is included the job title, the corresponding Office of Education (O.E.) and the Dictionary of Occupations Titles (D.O.T.)[1] numbers, the D.O.T. job definitions, possible job locations, educational requirements for entry, salary information, and opportunities for career advancement.

| | |
|---|---|
| MAJOR JOB TITLE: | Forester Aide |
| O.E. NUMBER: | 01.07 00 00 |
| D.O.T. NUMBER: | 441.384 |
| D.O.T. DEFINITION: | Works alone or as a member of a crew to inventory, protect, and reforest timber lands performing any combination of the following duties: |

[1] Dictionary of Occupation Titles, 3rd ed., U.S. Department of Labor, United States Government Printing Office, 1965.

Observes, measures, and records forest data such as tree species, volume of merchantable timber, topographic features, and tree seedling mortality; measures and maps such areas as burns, cut-over areas, experimental plots, and timber sales sections using slope compass and chain. Compiles data from recording or measuring instruments such as rain gauge, thermometer, stream flow records, and soil moisture gauge. Participates in enforcement of recreation rules and regulations relating to parking, campfire, use of facilities and sanitation to insure protection of picnic sites, camp grounds, and hunting and fishing areas. Answer questions on regulation, facilities, prevalence, and types of wildlife and tree species. Perform seasonal work such as planting trees, spraying pesticides, pruning, and thinning trees to improve stands, patrolling area to detect and report fires, and hazardous conditions or leading a crew to suppress forest fires.

LOCATION: State or Federal Government Service

SALARY: $5,996/yr. on full-time basis
$3/hr. and up on hourly or seasonal basis

EDUCATION: A high school diploma is essential. Some aide positions will require additional training such as that offered in community college two-year programs or university short courses. In most instances the prospective employee must pass a written examination.

CAREER ADVANCEMENT: Forest Technician in government service or positions in private industry.

MAJOR JOB TITLE: Fire Patrolman

O.E. NUMBER: 01.07 02 00 00

D.O.T. NUMBER: 441.687

D.O.T. DEFINITION: Patrols assigned areas of forests to locate and report fires and hazardous conditions and to insure compliance with

fire regulations by travelers and campers. travels on foot, horseback, or vehicle to vista points to scan for fires and unusual or hazardous conditions. Report findings and receive and relay emergency calls, using telephone or 2-way radio. Visits camping sites in area to inspect activities of campers and insure compliance with forest use and fire regulations. Extinguish smoldering fires with portable extinguisher, shovel and axe. May serve as crew leader for larger fires. May render assistance or first aid to lost or injured person. May participate in search for lost travelers or campers. May be stationed at a mobile point except when engaged in fighting fire or investigating unusual conditions elsewhere in the forest.

LOCATION: State or Governement Service, patroling forested areas to locate, report, and suppress fires or treat other hazardous conditions.

SALARY: $4,800/yr. and up
$3/hr. on hourly or seasonal basis
The nature of the work may result in overtime pay at 1 1/2 to 2 times normal hourly base.

EDUCATION: A high school diploma is usually required. Additional training may be undertaken at community colleges or special instructional programs offered by public agencies.

CAREER ADVANCEMENT: Crew Chief or Dispatcher

MAJOR JOB TITLE: Faller

O.E. NUMBER: 01.07 03 00 00

D.O.T. NUMBER: 940.884

D.O.T. DEFINITION: A faller may also be called a chopper, cutter, lumber faller, timber cutter, tree faller, or feller.
Fells trees, working alone or as a member of two man crew. Determines direction to fell tree to facilitate skidding and minimize danger of personal injuries,

avoid breaks and damage to the trees, cleans brush from around base of tree and escape route using axe. Saws or chops undercut in bole (trunk) of tree to fix direction of fall, using power chainsaw or hand crosscut saw and axe, and saws from opposite side to make back cut and fell tree. Drives wedges into back cut behind saw with maul to tip tree and avoid binding saw. May fell snags and saplings in path of tree fall to prevent throwback. May cut limbs from tree (limber). May cut tree into log lengths (bucker).

LOCATION: Federal, State, and privately owned forest lands

SALARY: Salary is quite variable, but begins at $2.50/hr. Many employers pay on a per piece or volume basis. Skilled workers may gross up to $10,000/yr.

EDUCATION: A high school diploma is desirable. Training or field experience in felling trees is generally required. Some employers may require the prospective employee to pass a written test.

CAREER ADVANCEMENT: Crew Boss, Timber Cruiser, Timber Marker, Heavy Equipment Operator, or Timber Buyer.

MAJOR JOB TITLE: Cordwood Cutter

O.E. NUMBER: 01.07 03 00 00

D.O.T. NUMBER: 940.884

D.O.T. DEFINITION: The Cordwood Cutter may also be called a pulpwood cutter or woodchopper. Fells trees in forest and cuts and splits logs into sizes suitable for stove or fireplaces using power, or crosscut saw, axe, wedges and maul. Stacks wood in ricks and cords. May load wood on truck and deliver to mill, fuel yard, or customer.

LOCATION: Federal, State, and privately owned forest lands

SALARY: Salary is variable depending on nature of

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| | employer, skill and motivation of employee, and market and weather conditions. General range $4,000 to $7,500. |
| EDUCATION: | A high school diploma is desirable. Training or field experience in cordwood operations is generally required. Some employers may require the prospective employee to pass a written test. |
| CAREER ADVANCEMENT: | Logger, Crew Boss, Heavy Equipment Operator, self-employment in own business. |

| | |
|---|---|
| MAJOR JOB TITLE: | Sawmill Worker |
| O.E. NUMBER: | 01.07 04 00 00 |
| D.O.T. NUMBER: | 667.782 |
| D.O.T. DEFINITION: | Performs any combination of following duties in preparing logs for cutting into lumber and storing cut lumber in sawmill: Unloads logs from trucks or cars. Rolls logs onto sawmill dock (dockman). Examine logs for defect, such as imbedded pieces of iron or stone, decayed wood and splits, and marks them for removal by other workers. Rolls logs from dock onto log carriage (log turner). Rides log carriage of head saw and adjusts position of logs on carriage to cut planks of required thickness (block setter). Sorts and guides planks emerging from saw onto roller tables or conveyors for trimming edges. Straightens lumber on moving conveyors (lumber straightener or trimmer). Operate sawing machine to straighten edges of rough lumber (edge man). May operate and maintain donkey engines. May sharpen and adjust teeth of wood saws (saw filer). |
| LOCATION: | May be employed in any locality where sawmilling or logging operations exist. |
| SALARY: | Salary range $5,000 to $10,000 per year depending upon specific duties, skill, and type of employer. |

EDUCATION: A high school diploma is desirable. Mill training as an understudy and/or field experience is generally required. Some assignments may require passing a written examination.

CAREER ADVANCEMENT: Head Sawyer, Lumber Grader, Lumber Inspector, product sales, Raw Materials Purchaser

MAJOR JOB TITLE: Park Worker

O.E. NUMBER: 01.07 05 00 00

D.O.T. NUMBER: 407.887

D.O.T. DEFINITION: The Park Worker may have several titles such as Park Cleaner, Park Repairman, Maintenance Worker, etc. Keeps grounds of city, state or national park clean and repairs buildings and equipment. Mows lawn, using hand mower or power-driven lawnmower. Grubs and weeds around bushes, trees, and flower beds and trims hedges. Picks up and burns or carts away paper and rubbish. Repairs and paints benches, tables, guard-rails and assists in repairs of roads, walks, buildings, and mechanical equipment using handtools. Cleans comfort stations and other buildings.

LOCATION: Local, State, and Federal park and recreation areas

SALARY: $4,000/yr. to $7,500/yr.
$3.09/hr. and up for seasonal employment

EDUCATION: A high school diploma is desirable. Local training or experience for specific assignments may be required.

CAREER ADVANCEMENT: Crew Boss, Grounds Supervisor, Assistant Park Ranger

| | |
|---|---|
| MAJOR JOB TITLE: | Nursery Worker |
| O.E. NUMBER: | 01.07 06 00 00 |
| D.O.T. NUMBER: | 406.887 |
| D.O.T. DEFINITION: | Plants, cultivates, and harvests trees, shrubs, and ornamental flowering plants in nursery. Mixes soil with other material such as sand and moss, to prepare seed beds, and plant specified seeds, seedlings or bulbs. Removes plants from beds and transplants them in pots or fields or packs them for shipment . . . Fumigate plants to kill insect pests. Picks out and discards defective plants. Grafts buds onto trees of different varieties as directed . . . |
| LOCATION: | Employed in State Forest Tree Nurseries or Commercial Ornamental Nurseries |
| SALARY: | $4,000/yr. to $6,500/yr.<br>$2.50/hr. and up for seasonal work |
| EDUCATION: | A high school diploma and training in nursery work is highly desirable. Field experience may substitute for classroom training. Many community colleges offer two-year programs in nursery work training. Short courses and night classes are often available at universities. For some jobs with certain employers, a written test may be required. |
| CAREER ADVANCEMENT: | Crew Boss, Packing Shed or Shipping Clerk Supervisor, Sales Personnel |

| | |
|---|---|
| MAJOR JOB TITLE: | Tree Planter |
| O.E. NUMBER: | 01.07 06 00 00 |
| D.O.T. NUMBER: | 441.887 |
| D.O.T. DEFINITION: | Plants seedlings in predetermined forest areas. Carries plant wrapped in wet moss and digs holes of prescribed size, using long-handled mattock or planting bar. Places seedling in hole with roots in specific position and tamps dirt around plant with foot and mattock. |

| | |
|---|---|
| | Paces off specified distance to next spot and repeats planting process. |
| LOCATION: | May be employed wherever an afforestation or reforestation operation exists. |
| SALARY: | $4,00/yr. to $6,500/yr. Season workers are often paid on a per tree or per acre planted base. |
| EDUCATION: | A high school education is desirable. Prospective federal employees may be required to pass a written test. |
| CAREER ADVANCEMENT: | Crew Boss |

| | |
|---|---|
| MAJOR JOB TITLE: | Tree Pruner |
| O.E. NUMBER: | 01.07 06 00 00 |
| D.O.T. NUMBER: | 441.887 |
| D.O.T. DEFINITION: | Prunes and thins out forest trees according to instructions, to improve timber quality and growing conditions. Removes lower limbs from young trees, using saw, pruning loppers, or pole pruner to increase volume of knot free lumber when tree is cut. Cuts out diseased trees and undesirable species to properly space trees and reduce competition for light and nutrients among desirable trees in stand. May plant trees (tree planter). May spray trees with pesticides. |
| LOCATION: | Employed by Federal, State, or Commercial Agencies on forested lands. |
| SALARY: | $4,000/yr. to $6,500/yr. |
| EDUCATION: | A high school diploma is desirable. Prospective federal employees may be required to pass a written test. |
| CAREER ADVANCEMENT: | Crew Boss |

COMPETENCIES FOR CLUSTER AREAS

## VII. Forestry

### A. Forests

The student must understand and appreciate the concept of proper management of the total forest ecosystem. Wise use of forest resources on a "take some, leave some" basis is essential. Both the maintenance of existing natural timber stands and the establishment of new forests are included. The student must be able to define and explain the five major benefits of the forest: wood, water, wildlife, range, and recreation. Multiple use, integrated resource management, must be practiced, with the student capable of designating proper priorities of use for each timbered area based upon the biological potential of productivity, the existing market and economic conditions, and the social needs and desires of the people.

The student should be able to:

EE 1. Collect foundation data from the forest and the site.

EE 2. Obtain continuous growth of the forest by applying proper forest management and maintenance techniques.

EE 3. Determine the proper method of harvesting mature forest crops.

EE 4. Recognize potential hazards of insect, disease, fire, and activities of man to the forest.

EE 5. Prescribe the proper procedures for afforestation and reforestation including seedbed preparation, planting practices, the spacing to be used, and species selection.

KEY: EE-ESSENTIAL FOR ENTRY
DA-DESIRABLE FOR ADVANCEMENT

EE 6. Supervise field crews.

EE 7. Have a knowledge of current forest laws.

EE 8. Estimate the value of the existing and potential forest resources.

DA 9. Prepare a comprehensive long-range management plan.

B. Forest Protection

The Fire Patrolman must be familiar with the subject areas of fire control including prevention, detection, suppression, behavior, and use of fire in prescribed burns. He must also know the laws pertaining to fire and have a first-hand knowledge of safety practices and first aid procedures. He must be in good health and be willing and capable of working long hours under sometimes arduous and hazardous conditions.

The student should be able to:

EE 1. Detect and locate a fire.

EE 2. Serve as a crew member for:
a. Fire suppression and mop-up
b. Fire prevention and trash disposal
c. Prescribed burning

EE 3. Take weather measurements.

EE 4. Serve as a lookout at fire detection centers.

EE 5. Report size and location of fire to dispatchers.

EE 6. Assess and utilize proper safety procedures for himself and crew members.

DA 7. Plan the fire control program for a fire, including mop-up.

DA 8. Make fire reports on action taken, cause of fire, crew reports, and fire effects.

DA 9. Conduct safety lessons and teach first aid procedures.

DA 10. Serve as crew chief or fire dispatcher.

DA 11. Give instruction in the use of fire tools and equipment, crew organization and fire logistics.

C. Logging

Logging involves the harvesting of forest trees. Felling, marking, limbing and bucking are all part of the logging process before logs are removed (skidded) from the harvest site. The faller/feller cuts down the tree, the marker marks the tree stem into log lengths, the bucker cuts the stem into the designated log lengths, and the limber removes the side branches and limbs. The specific task for each operation (job description) are different, but the general nature of the work is similar. With smaller companies or on smaller logging operations, one person may perform all or any of the operations. Large companies may have an individual assigned to each specific operation. Very few companies will hire an inexperienced person as a timber faller, marker, or bucker. Experience is usually gained by working as an apprentice or assistant under the supervision of experienced personnel.

The logger must work under dangerous and often difficult conditions. Rough terrain and foul weather may present undesirable working conditions. Only rugged individuals with good health, at least average strength, and good vision who enjoy strenuous outdoor work should consider logging activities for employment. The logger must also possess a "feeling" for the woods, having an awareness at all times for the location of fellow crew members, position of equipment, and rapidly changing conditions which affect the safety of himself and his crew members.

The student should be able to:

EE 1. Show proficiency in felling, limbing, and backing trees.

EE 2. Use both the hand tools and the power equipment which are associated with the logging operation.

EE 3. Service and maintain all types of tools and equipment.

EE 4. Gain the greatest volume and/or quality from each tree felled.

EE 5. Fell individual trees with a minimum of damage to the residual stand.

EE 6. Insure maximum safety to all crew members.

EE 7. Insure minimum damage to equipment.

DA 8. Select and mark mature trees to be harvested.

DA 9. Optimize the savings in time and labor in a logging operation.

DA 10. Familiarize himself with all phases of the harvest operation, including felling, skidding, and loading.

DA 11. Scale (measure) timber and logs. In order to prepare woods reports, tally data by species, volume, and grade.

D. Wood Utilization

There are numerous types of work involved in wood utilization, some of them highly technical in nature and requiring at least a four-year college degree. The activities range from those related to harvest operations in the forest to a variety of job types at the sawmill. The work may involve scaling (measuring) of incoming raw materials, moving logs to the sawmill rig, being involved in the sawmill operation, or grading and handling lumber after it has been sawn.

Some sawmill work is rugged and hazardous. The sawmill worker must be in good health, constantly alert, and capable of on-the-spot good judgement. In large sawmill operations an individual may be assigned to a specific task. Many smaller operations will employ only persons capable of handling several chores. For industrious and competent workers the opportunity for advancement in rank and salary increments is excellent.

The student should be able to:

EE 1. Identify trees by their wood and bark.

EE 2. Accurately measure logs for determining volume.

EE 3. Class processed lumber by use-class and grade.

EE 4. Maintain and repair equipment.

EE 5. Demonstrate a knowledge of proper safety procedures and first aid techniques.

EE 6. Maintain mill records by species, volume, and grade.

EE 7. Show an understanding of sawmill terminology and general operating procedures.

DA 8. Measure wood by any one of several different measurements, such as the cord, board foot, cubic foot, etc.

DA 9. Become familiar with the standard log rules including Doyle, Scribner Decimal C, and International.

DA 10. Accurately inventory both raw materials and processed wood.

DA 11. Recognize and estimate amount of defects in wood such as rot, ringshake, crook, etc.

DA 12. Improve his skills in mathematics and accounting.

DA 13. Gain an understanding of the problems of the timber grower and logger.

DA 14. Study federal and state legislation governing timber harvesting, processing, and sales.

DA 15. Improve his communication skills.

E. Recreation

The use of forest lands for recreation activities has increased rapidly in recent years. Forestry and conservation practices often create recreation opportunities. for example, a new lake in a forest environment provides fishing, boating, and swimming. Picnic and/or campsite facilities are often included in forest management planning. Recreation workers are found in national parks and forests, state and community parks and forests, game preserves, playgrounds, golf courses, resorts, amusement parks, etc.

For many types of recreation jobs, a high school education is the minimum requirement. For year-round employment an associate degree from a two-year program is usually required. Those who plan, direct, or administer recreation programs or areas may need a degree from a four-year program at the university level.

The student should be able to:

EE 1. Present interpretive programs, lead and escort park visitors, and explain the role of recreation enterprise and the diversity of activities available.

EE 2. Develop good oral communication skills.

EE 3. Keep accurate records and make reports.

EE 4. Describe local flora and fauna.

EE 5. Have a knowledge of the historical background of the area and social influences.

EE 6. Use proper first aid techniques and be aware of general safety procedures.

DA 7. Determine the needs and locations for roads, trails, buildings, and equipment.

DA 8. Develop, supervise, and/or direct recreation programs.

DA 9. Be aware of maintenance problems and the effect on the forest ecosystem of existing and proposed programs.

DA 10. Have a working knowledge of all pertinent laws and regulations.

DA 11. Develop a budget for conducting recreation programs.

DA 12. Determine the nature and range of possible or potential recreation activities in the area.

DA 13. Conduct classes to train other recreation workers, teach campers how to maximize the enjoyment of a quality recreational experience, and provide assistance to lost or injured visitors.

F. Special Products

Over 2000 different products are produced on our forest lands. The number is even larger if products and activities related to the forest are included: such as fish, game, and wildlife; recreation; water resources; and miscellaneous conservation programs. Obviously a great many types of workers are needed to help provide and/or produce the full benefits of forest resources. In this section, competencies for job titles for Nursery Worker, Tree Planter, and Tree Pruner are listed. Other special products job titles include: Sprayer, Tree Climber, Gum Gatherer, Christmas Tree Worker, Greens Picker, Seed and Cone Picker, Bough Cutter, Sampler, etc. Most of the special products workers' jobs are seasonal in nature. However, many individuals may gain full or nearly full time employment by combining two or more sets of competencies in order to qualify for more than one job.

Competencies will differ somewhat depending on the general nature of the special products job. For instance, competencies for Bough Cutter, Greens Picker, and Christmas Tree Worker fall into one general grouping whereas competencies for the Nursery Worker or Tree Planter are not the same. In practice the Nursery Worker may also be called upon to perform as a Seed or Cone Picker, a Tree Planter, Sprayer, etc. Many special products jobs have similar overlap. Therefore, it is most advantageous here to list for special products workers only a few general competencies. These should include:

EE 1. The ability to identify trees by species at any age.

EE 2. A knowledge of how to care for trees and shrubs, including a knowledge of the principles of plant growth.

EE 3. The ability to operate portable power equipment such as chainsaws and sprayers.

EE 4. The ability to select and use the proper hand tool for the task at hand.

EE 5. Know how to maintain and perform field repairs on tools and equipment.

EE 6. Good health and stamina, willingness to work outdoors in adverse weather, and an enjoyment of working with plants.

DA 7. Willingness to assume responsibility, an interest in his work, and a knowledge of the organization and operation of the business.

DA 8. Prove the ability to organize and supervise field crews.

## VII. Forestry

### A. Forests

### Forester Aide

The Forester Aide must have an interest in forest conservation. He must enjoy working outdoors and have reasonably good health. He should be able to work with a crew or alone. The working hours often vary, depending upon the time of year and immediate conditions. The Forester Aide will be called upon to perform a wide variety of assignments. In some instances for specialized work, he may need to attend locally offered short courses. These often are provided by the employing agency at no cost. General competencies should include the following:

EE 1. Ability to use an assortment of forestry tools and equipment.
   a. Instruments for measuring tree diameter, height, stem volume, and growth.
   b. Weather instruments for measuring or recording temperature, humidity, wind velocity, precipitation.
   c. Other instruments such as stream-flow gauge, traffic counters, fire tools, insect traps, etc.

EE 2. Know how to read, interpret, and construct forest maps. He may need to be familiar with compasses, instruments for determining slope, steel surveying tapes, and laboratory plotting instruments.

EE 3. Use aerial photographs.

EE 4. Record, compile, and make preliminary data analysis.

KEY: EE-ESSENTIAL FOR ENTRY
DA-DESIRABLE FOR ADVANCEMENT

EE 5. Prune and thin forest trees, using the proper tool for the task at hand.

EE 6. Identify the locally important forest tree species on sight, knowing how to use a plant key to determine the identity of unfamiliar species.

EE 7. Be familiar with pertinent regulations regarding use of forest facilities including wildlife statutes, enforcement of recreation rules, and laws regarding open burning, protected areas, and pesticide application.

EE 8. Use appropriate safety procedures in accordance with safety laws and codes.

EE 9. Implement the appropriate site preparation, planting method, and harvest technique to be used on a particular site.

EE 10. Evaluate the site upon which a timber stand exists or upon which a planting or seeding is to be made.

EE 11. Recognize the existence of cash products, recreational benefits, and aesthetic values for maximizing multiple use aspects of the stand.

EE 12. Detect, locate, and suppress wildfires.

EE 13. Interpret information available in stand tables, yield tables, stocking tables, and other forest inventory data.

EE 14. Establish plots, usually 1/5 acre, and pinpoint their location on maps.

EE 15. Identify mature trees and mark them for harvesting.

EE 16. Use sprayers for use in applying pesticides and herbicides.

EE 17. Be responsive to the public in answering questions and requests for assistance.

DA 18. Undertake additional study in mathematics, biological sciences, natural resources, and social relationships.

B. Forest Protection

Fire Patrolman

The Fire Patrolman must combine intellect, training, and common sense if he is to effectively and safely control forest fires. He must recognize wildfire as an enemy of the forest, but also be aware of the role of prescribed burning as a beneficial tool in forest management. Since fire occurrence is periodical in nature, he often performs other tasks such as trail building and maintenance; searching for lost campers or travelers; assisting in patroling areas to inspect forest visitor activities and insuring compliance with forest use regulations.

The student should be able to:

EE 1. Construct a fire line on different terrains under various fire conditions.

EE 2. Use properly fire suppression hand tools such as fire rakes, pulaski tools, flappers, axes, broom rakes, shovels, sprayers, etc.

EE 3. Be familiar with the effective use of power tools such as chainsaws, pumps, tractors, etc.

EE 4. Assist in communications using the telephone and two-way radios.

EE 5. Read and record accurately the instruments for collecting weather data, including thermometers, hygrometers, anemometers, etc.

EE 6. Compute and interpret fire danger index ratings.

EE 7. Understand the behavior of surface, ground and crown fires of varying intensities upon differing terrains.

EE 8. Use maps, compasses, and landmarks to locate fires.

EE 9. Use first aid procedures.

EE 10. Insure that he himself and all crew members are wearing proper clothing, understand the specific assignment, and perform all activities in a safe and proper manner.

EE 11. Emphasize, above all, safety for himself, crew members, and any other persons in the locality. Safety of personnel has precedence over immediate fire suppression.

DA 12. Plan a fire control program using a fire simulator.

DA 13. Coordinate all resources in a district in order to combat large fires.

DA 14. Understand the effects of fire on the forest environment, especially in order to use prescribed burning to achieve specific goals.

DA 15. Know when, where, and how to employ backfires.

DA 16. Instruct others and organize fire crews in the proper manner so that they understand the various techniques and proper approach to fire control under a wide range of conditions.

DA 17. Undertake additional study in fire control, meteorology, physiography, communications, and use and maintenance of equipment.

C. Logging

Faller

The Faller (Feller) must be able to perform several varying activities during the harvest operation. He must be able to plan and carry out logging operations in different types of timber on varying sites, often under adverse conditions. He must be able to cooperate with other personnel if the logging operation is to be conducted in an efficient and safe manner. General competencies should include the following:

EE 1. Must be able to use axes, wedges, mauls, chainsaws, etc. under all woods conditions.

EE 2. Should know how to fell trees in a specified and desired direction.

EE 3. Be able to mark, limb, and buck felled trees into proper lengths for clean logs.

EE 4. Should know how to safely fell diseased or lodged trees.

EE 5. Must recognize factors such as lean, crown form, defects in the tree, obstacles, and wind velocity and direction which can cause problems in proper placement of the trees to be felled.

EE 6. Be able to create safety routes for the feller.

EE 7. Know how to minimize damage to residual crop trees.

EE 8. Determine the proper equipment to be used for making undercuts and back-cuts.

EE 9. Provide for the safety of the feller and other crew members.

EE 10. Know how to choose clothing and footwear for comfort and safety.

EE 11. Be able to render first aid under field conditions.

EE 12. Know how to service and maintain hand tools and chainsaws in the field.

EE 13. Recognize those conditions which make work too hazardous, such as faulty equipment, rough terrain, bad weather, etc.

Cordwood Cutter

The description and duties of the Cordwood Cutter are generally the same as those for the Faller. Many woods workers will qualify as both. The Cordwood Cutter harvests trees for pulpwood, fuelwood, and feedstocks (material for extraction of chemicals). These trees are frequently, but not always, of smaller size than those harvested by the Feller.

The Cordwood Cutter may have certain additional tasks such as splitting logs or bolts into smaller pieces, piling processed wood into ricks or cords, loading wood onto trucks, and delivering to customers or holding yards. For cluster competencies and job title competencies, refer to Logging and Feller.

D. Wood Utilization

Sawmill Worker

There are many kinds of tasks performed by the Sawmill Worker. In some instances, the nature of his work is similar to that of the Faller or the Cordwood Cutter. At the sawmill itself, there are at least a dozen different types of work to be done. Generally the larger the mill operation, the greater the job specialization. At smaller operations, the Sawmill Worker will nearly always perform in several capacities. For promotion beyond a common laborer, the Sawmill Worker must understand the overall sawmill procedure, especially in his area of assignment; be able to react quickly to changing situations and to think things out for himself; be able to handle more than one specific type of job; and familiarize himself with

the flow of wood from rough raw materials to processed products. Competencies should include the following:

EE 1. Be able to identify accurately all local commercially important species by bark and wood characteristics.

EE 2. Know how to measure, within plus or minus two percent accuracy, the volume of logs.

EE 3. Know how to measure with 100 percent accuracy the board foot content of processed lumber.

EE 4. Know how to identify logs by grade including factory class, construction class, yard lumber logs, and veneer logs.

EE 5. Know how to operate skillfully at least one of the following: edger, trimmer, carriage rider, fork lift, log deck loader, trucks and/or tractors, chainsaw, or debarker.

DA 6. Be able to estimate log defect extent by size, location, and type.

DA 7. Know how to measure and tally lumber by species, volume, and grade.

DA 8. Have a working knowledge of grade standards for all classes/uses of sawlumber.

DA 9. Know how to saw each log in order to obtain the greatest volume and/or quality of lumber, determining the poorest log face.

DA 10. Be able to pass an exam qualifying him for log buyer, timber buyer, or inspector of forest products.

DA 11. Be sufficiently familiar with several phases of mill operation and organization to become a crew boss or other supervisor.

DA 12. Know how to proficiently operate as the head sawyer.

DA 13. Become familiar with the inventory and sale of mill products.

E. Recreation

Park Worker

There are many kinds of Park Workers. The job

competencies listed here are those required for the individual whose primary duties are related to construction of recreation facilities, maintenance and repair of physical improvements and park grounds, and clean-up and patrol of recreation areas. For these tasks, a high school education is generally sufficient. For promotion in rank and/or salary the employee must demonstrate the ability to assume responsibility and leadership, interest in the conduct and welfare of the recreation program, the willingness to undertake additional training, and evidence of initiative.

Competencies should include the following:

EE 1. The skills needed for maintenance and repair of structures such as carpentry, painting, etc.

EE 2. The ability to operate powered equipment such as mowers, sprayers, chainsaws, etc.

EE 3. Proper procedures for caring for lawn areas, flowers, shrubs, and trees.

EE 4. Know how to maintain trails and camping and/or picnic areas.

EE 5. Be able to follow and perform sanitation and clean-up procedures.

EE 6. Have some familiarity with the basic regulations governing use of and activities on recreation areas so that violations can be spotted and reported to the proper authorities.

EE 7. Be familiar with communication and transportation facilities of his area in order to assist park visitors and search for lost persons.

EE 8. Be generally familiar with park facilities so that assistance in locating specific areas, activities or sources of additional information can be provided.

F. Special Products

Nursery Worker

The primary activities of the Nursery Worker are directed to growing seedlings and plants for forest planting, parks and watersheds, landscaping, and orchard planting. Nurseries may be privately owned

or be public facilities which serve Federal or State forestry programs. The Nursery Worker may be involved in seed collection, greenhouse work, and maintenance of nursery grounds and facilities. In private nurseries he may at times also serve on the sales staff. Competencies should include the following:

EE 1. The ability to identify tree, shrub, and weed species.

EE 2. A knowledge of the uses of nursery-grown species.

EE 3. A knowledge of the principles of plant growth.

EE 4. Farm or gardening experience or equivalent educational training.

EE 5. Know how to prepare seedbeds and transplant seedlings.

EE 6. Know how to properly fertilize, water, and cultivate seedling beds.

EE 7. The ability to propagate plants asexually by budding, grafting, or layering.

EE 8. Know how to dig (lift), grade, and pack plants for shipment.

EE 9. The ability to use powered nursery equipment including vehicles, sprayers, various cultivators, irrigation systems, spreaders, etc.

EE 10. In commercial nurseries, know how to cut, lift, and lay sod.

EE 11. Experience or training in maintaining and repairing buildings and equipment.

DA 12. Courses in nursery management, plant propagation, plant growth and development, and soil physics and soil fertility.

DA 13. Courses in cultural practices for plants, both in the nursery and after outplanting, and landscape planning.

DA 14. Business courses concerning the keeping of records, personnel management, communications, and salesmanship.

DA 15. Evidence of a knowledge of the business, an

interest in the work, and the ability to supervise other workers or crews.

DA 16. The ability to use specialized nursery equipment such as lifters, seed cleaners, chemical applicators, etc.

DA 17. Be able to recognize disease and insect problems and prescribe proper control measures for them.

Tree Planter

The work of the Tree Planter is usually seasonal. It is generally used as part-time employment or used between periods of other employment in any of several other related forestry jobs such as Tree Pruner, Christmas Tree Worker, Seed and Cone Collector, Nursery Worker, or occasionally jobs related to logging or forest protection. Competencies for the Tree Planter include:

EE 1. Ability to identify species in the seedling stage and, for large fruited species as the nut trees (walnut, hickory, oak, etc.), as seed.

EE 2. Familiarity with proper planting procedures when using:
a. Hand tools--mattock, grub hoe, dibble, planting bars, spades, etc.
b. Machine planting--tractor pulled tree planters, self-powered transplanters.
c. Spraying equipment for application of herbicides, pesticides, and fertilizers.

EE 3. Be able to follow instructions in order to attain proper spacings, species arrangements, and planting design.

EE 4. Know how to protect and store seedlings after receiving them but before field planting time--lining out, heeling in, and cold storage.

EE 5. Know how to make direct seeding of appropriate species where seed rather than seedlings may be planted.

EE 6. Achieve at least 80 percent first-year survival, knowing how to make a field check of field performance of survival and growth.

DA 7. Know how to assess a prospective planting site by soil, climate, and purpose of planting in order to determine adaptable species.

DA 8. Know how to layout and design a planting.

DA 9. Knowing species and nature of planting, be able to organize personnel and equipment to accomplish the task efficiently.

DA 10. Be willing to assume responsibility and supervise field crews.

DA 11. Have the ability to bargain or contract for planting jobs.

DA 12. Course work in business management, soils, herbicides, and silvics is desirable for advancement beyond semi-skilled class of worker.

Tree Pruner

The Tree Pruner usually works in urban or suburban localities. His work is closely related to that of the Tree Surgeon. In the forest, he may perform timber stand improvement work by pruning the lower branches (from the butt log) in order to produce high quality logs in crop trees of valuable species. Employment is usually by privately owned companies or municipal government units. General competencies include:

EE 1. The ability to use hand saws, polesaws, pruners, and chainsaws.

EE 2. A knowledge of proper climbing techniques utilizing ropes, climbing saddles, and attachments.

EE 3. The ability to drive trucks and operate choppers and chippers.

EE 4. Common sense and good judgement regarding safety for himself and fellow workers.

EE 5. The ability to prune out defective branches and remove dead, damaged or diseased trees without damage to other trees and plants, wiring, or structures.

EE 6. The ability to direct vehicle traffic and proper regard for pedestrians.

EE 7. Knowing facts about the growth habits of various tree species.

EE 8. An appreciation for the natural beauty of trees and how to attain maximum utility of each tree by proper tree maintenance.

DA 9. Experience in work or attendance at short courses to learn modern tree care techniques.

DA 10. Attending courses in safety, record keeping, bookkeeping, mechanics, and communications.

DA 11. Expression of interest in the company's work and its customers, willingness to accept responsibility, and desire for advancement beyond semi-skilled work.

| Course Outline | Reference Code | Reference |
|---|---|---|
| VII. Forestry | | |
| A. Forests | | |
| 1. Introduction to Forestry | TR-SR | Allen, Shirley W. and Sharp, G.W. 1960. An Introduction to Forestry, 3rd Ed. (2) |
| a. Multiple use concept | | |
| (1) wood | SR | Hilterbrand, L.R. 1967. An Introduction to Forestry. (24) |
| (2) water | TR-SR | U.S.D.A. 1949. Trees, Yearbook of Agriculture, 1949. (46) |
| (3) wildlife | SR | Allen, Shirley W. and Leonard, J.W. 1966. Conserving Natural Resources, 3rd Ed. (1) |
| (4) range | TR | Davis, Kenneth P. 1966. Forest management, 2nd Ed. (19) |
| (5) recreation | TR | Harlow and Harran. 1968. Textbook of Dendrology, 5th Ed. (22) |
| b. Importance and values | SR | Mohlenbrock, Robert H. 1973. Forest Trees of Illinois. (27) |
| c. Social aspects | | |
| (1) Historical background | | |
| (2) Laws and regulations | | |
| (3) Social influences | | |
| (4) Public relations | | |
| 2. Identifying forest trees and shrubs (see Exemplary teaching plan in this guide) | | |

KEY: TR-TEACHER REFERENCE
SR-STUDENT REFERENCE

| Course Outline | Reference Code | Reference |
|---|---|---|
| 3. Mensuration | | |
| a. Sampling procedures | SR | Beers and Miller. 1973. Manual of Forest Mensuration, T&C Enterprises. (11) |
| (1) fixed plots<br>(2) strip method<br>(3) line-intersect method and procedures | | |
| b. Units of forest measurement and scaling | | |
| (1) board foot and cubic foot<br>(2) ricks and cords<br>(3) weight or unit volume<br>(4) linear foot or piece<br>(5) tree scale<br>(6) log rules and log scales (see also exemplary teaching plan in this guide) | | |
| c. Instruments for measuring and/or recording field data | SR | Avery, T.E. 1967. Forest Measurements. (5) |
| (1) tree heights and diameters (dbh) | TR | Husch, B., Miller, C.I., and Beers, T.W. 1972. Forest Mensuration, 2nd Ed. (25) |
| (2) volume and growth<br>(3) soils and site factors<br>(4) climatic data<br>(5) distance and area | TR | Avery, T.E. 1975. Natural Resource Measurements. 2nd Ed. (7) |
| d. Laboratory instruments for: | | |
| (1) soil and plant tissue analysis | | |
| (2) map and aerial photograph interpretation | TR | Avery, T. Eugene. 1968. Interpretation of Aerial Photographs. 2nd Ed. (6) |
| (3) weight, density, moisture content, and wood structure. | TR | Panshin, A.J. and deZeeuw, Carl. 1970. Textbook of Wood Technology Vol. 1, 3rd Ed. (32) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| e. Assemblying and interpreting data | | |
| (1) Construction of data tables<br>(a) volume tables<br>(b) yield tables<br>(c) stand tables<br>(d) stocking tables | TR | Husch, B., Miller, C.I., and Beers, T.W. 1972. Forest Mensuration, 2nd Ed. (25) |
| (2) Site index and growth curves | TR | Smith, D.M. 1962. The Practice of Silviculture. 7th Ed. (38) |
| (3) Area measurements and other information<br>(a) from field data<br>(b) from maps<br>(c) from aerial photographs | TR-SR | Sipe, F.H. 1970. Compass Land Surveying. (35) |
| | TR | Avery, T.E. 1968. Interpretation of Aerial Photographs. (6) |
| (4) Data summarization | | |
| 4. Cultural Practices | | |
| a. Preparation of forest site for planting | | |
| (1) mechanical cultivation<br>(2) prescribed burning<br>(3) herbicide application | TR | Toumey, James W. and Korstian, Clarence F. 1957. Seeding and Planting. 3rd Ed. (44) |
| b. Establishing the forest | | |
| (1) using seedlings or cuttings<br>(2) direct seeding by man<br>(3) utilizing existing seed trees | TR-SR | U.S.D.A.-Forest Service. 1974. Seeds of Woody Plants. Agr. Handbook No. 450. (49 |

| Course Outline | Reference Code | Reference |
|---|---|---|
| (4) coppice/sprout regeneration | | |
| c. Managing the growing forest | | |
| (1) thinning | | |
| (2) pruning crop trees | | |
| (3) irrigation and fertilization | | |
| (4) control of undesirable competing plants | TR-SR | Baker, F.S. 1950. Principles of Silviculture. (8) |
| (5) protecting against wildfire, insects, diseases and other damaging agents. | | |
| d. Harvesting the crop | | |
| (1) determine the harvest method | TR-SR | Baker, F.S. 1950. Principles of Silviculture. (8) |
| (a) single tree and group selection | SR | Hilterbrand, L.R. 1967. An Introduction to Forestry. (24) |
| (b) seed tree method | | |
| (c) shelterwood system | TR-SR | U.S.D.A.-Forest Service. 1974. Seeds of Woody Plants. Agr. Handbook No. 450 (49) |
| (d) regeneration or clearcut | | |
| (2) determine the time of harvest | TR | Wackerman, A.E., Hananstein, W.D. and Mitchell, A.S. 1966. Harvesting Timber Crops. (52) |
| (3) selecting the logging operations | TR-SR | A.C. 1963.Fundamentals of Logging. 5th Ed.(3) |
| 5. Soil, Site, and Climatic data | | |
| a. Evaluating soils | | |
| (1) texture and structure | SR-TR | Brady, Nyle C. 1974. The Nature and Property of Soils. 8th Ed. (53) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| (2) depth and parent material<br>(3) fertility<br>(4) aeration and internal drainage | TR | Wilde, S.A. 1958. Forest Soils. (53) |
| b. Determining site factors | | |
| (1) slope<br>(2) aspect<br>(3) elevation | SR | Smith, D.M. 1962. The Practice of Silviculture 7th Ed. (38) |
| (4) major drainage pattern | TR | Spurr, Stephen H. and Barnes, Burton V. 1973. Forest Ecology, 2nd Ed. (42) |
| c. Recording climatic data | | |
| (1) air and soil temperature | TR-SR | Petterssen, Sverre. 1958. Introduction to Meteorology. 2nd Ed. (33) |
| (2) precipitation<br>(3) wind velocity and direction<br>(4) relative humidity | | |
| 6. Protection | TR-SR | U.S.D.A. 1941. Climate and Man. Yearbook of Agriculture. 1941. (45) |
| a. Fire | TR | Brown, Arthur A. and Davis, Kenneth P. 1973. Forest Fire: Control and Use. (16) |
| (1) prevention<br>(2) detection<br>(3) suppression<br>(4) effects<br>(5) use (prescribed burning)<br>(6) behavior<br>(7) economics (see also exemplary teaching plan in this guide.) | SR | Caylor, Harry P. 1974. Wildfires: Prevention and Control. (17) |
| | SR | Illinois 1972, Manual for Forest Fire Fighters. Ill. Div. For. (26) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| b. Insects | | |
| (1) recognition of insect damage<br>(2) identification of injurious insects<br>(3) control of injurious insects<br>(4) pesticides-effects, laws, safety | TR | Graham, Kenneth. 1963. Concepts of Forest Entomology. (21) |
| | TR-SR | Baker, Whiteford L. 1972. Eastern Forest Insects. U.S.D.A.-For. Ser. Misc. Publ. No. 1175. (9) |
| c. Diseases | | |
| (1) recognition of pathogenic problems | TR | Boyce, John Shaw. 1966. Forest Pathology. 3rd Ed. (13) |
| (2) identification of tree diseases<br>(3) control of major tree diseases<br>(4) chemical application: effects, laws, and safety | TR-SR | Smith, William H. 1970. Tree Pathology. (40) |
| d. Other | | |
| (1) mammalian damage, including man<br>(2) pollution<br>(3) climatic extremes<br>(4) mechanical damage | TR-SR | Smith, William H. 1970. Tree Pathology. (40) |
| 7. Equipment-Use, Maintenance, and Repair | | |
| a. Shop maintenance and repair of power equipment | TR-SR | Owners' Manuals (30) |
| (1) the internal combustion engine (see exemplary teaching plan in this guide) | | |

| Course Outline | Reference Code | Reference |
|---|---|---|
| b. Field use and maintenance | TR | Small Engines Vol. 1. Care and Operation. AAVIM (36) |
| (1) chain saws and sprayers | TR | Small Engines Vol. 2. Maintenance and Repair. AAVIM (37) |
| (2) hand tools and equipment | SR | VAS Unit 3014. Small Engines, Principles of Operation. (50) |
| 8. Safety and first aid | | |
| a. Federal and state laws and regulations | | |
| b. Safety | | |
| (1) power equipment<br>(2) hand tools<br>(3) site and weather hazards<br>(4) biological hazards<br>(5) chemical, fire, and smoke | TR-SR | (Basic safety generally included in use and operation manuals.) |
| c. First aid techniques and procedures | TR-SR | American National Red Cross. 1957. First Aid Textbook. (4) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| B. Forest Protection | | |
| 1. Fire Control | SR | Caylor, Harry P. 1974. Wildfires: Prevention and Control. (17) |
| a. Prevention | SR | Illinois 1972. Manual for Forest Fire Fighters. Ill. Div. For. (26) |
| b. Detection | TR | Brown, Arthur A. and Davis, Kenneth P. 1973. Forest Fire: Control and Use. (16) |
| c. Suppression | | |
| d. Behavior | | |
| e. Tools and equipment (see exemplary teaching plan in this guide.) | | |
| 2. Weather | | |
| a. Reading and recording weather data | TR-SR | Pettersen, Sverre. 1958. Introduction to Meteorology, 2nd Ed. (33) |
| b. Behavior | TR-SR | U.S.D.A. 1941. Climate and Man. Yearbook of Agriculture, 1941. (45) |
| 3. Communication | | |
| a. Telephone | | |
| b. Two-way radio | TR-SR | Owners' Manuals (30) |
| 4. Cartography | | |
| a. Interpreting map data and information | TR-SR | Sipe, F.H. 1970. Compass Land Surveying. (35) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| b. Locating known locations and establishing location by intersect methods. | TR | Avery, T.E. 1968. Interpretation of Aerial Photographs. (6) |
| c. Determining road and trail routes | TR | Avery, T.E. 1975. Natural Resource Measurements. 2nd Edition. (7) |
| 5. Geology | TR | Bowman, Isaiah. 1911. Forest Physiography. (12) |
| a. Physiography | TR-SR | County Soil Survey Bulletins, S.C.S. (41) |
| b. Water relationships: sources, drainage patterns, etc. | | |
| 6. Safety and First Aid | TR-SR | American National Red Cross, 1957. First Aid Textbook. (4) |
| a. Personnel safety | | |
| b. Field first aid | | |
| C. Logging | | |
| 1. Felling, Bucking, and Limbing | TR-SR | A.C. 1963. Fundamentals of Logging, 5th Ed., Allis-Chalmers Mfg. (3) |
| a. Marking for cuts | | |
| b. Making the cuts | | |
| c. Minimizing damage to residual timber | TR | Wackerman, A. E., Hananstein, W. D., and Mitchell, A. S. 1966. Harvesting Timber Crops. (52) |
| d. Recognizing defective trees | | |
| e. Determining skidding and safety routes | | |
| 2. Splitting, Loading and Hauling | TR-SR | Avery, T. E. 1967. Forest Measurements. (5) |
| 3. Tools and Equipment | TR-SR | Owners' Manuals (30) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| a. Power tools | TR | Small Engines Vol. 1. Care and Operation. AAVIM. (36) |
| b. Hand tools | TR | Small Engines Vol. 2. Maintenance and Repair. AAVIM. (37) |
| (1) For measurements | | |
| (2) For harvesting (see also exemplary teaching plan in this guide) | SR | VAS Unit 3014. Small Engines, Principles of Operation. (50) |
| 4. Safety | | |
| a. Personnel relationships | TR-SR | (Basic safety generally included in use and operation manuals.) |
| b. Site factors | | |
| c. Weather factors | | |
| d. Biological factors | | |
| e. Clothing, boots, hard hats, etc. | | |
| 5. First Aid | TR-SR | American National Red Cross. 1957. First Aid Textbook. (4) |
| 6. Tree Identification (see also exemplary teaching plan in this guide) | TR | Harlow and Harrar. 1968. Textbook of Dendrology, 5th Ed. (22) |
| | SR | Mohlenbrock, R. 1973. Forest Trees of Illinois. (27) |
| D. Wood Utilization | | |
| 1. Tree Identification (see exemplary teaching plan in this guide) | TR | Harlow and Harrar. 1968. Textbook of Dendrology, 5th Ed. (22) |
| | SR | Mohlenbrock, R. 1973. Forest Trees of Illinois. (27) |
| 2. Wood Science | | |
| a. Forest products | TR | Panshin, A. J., Harrar, E. S., Baker, W. J., Proctor, P. B. 1950. Forest Products. (31) |
| b. Wood identification | TR | Panshin, A. J., DeZeeuw, Carl. 1970. Textbook of Wood Technology, Vol. 1, 3rd Ed. (32) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| 3. Mensuration | TR | Husch, B., Miller, C. I. and Beers, T. W. 1972. Forest Mensuration, 2nd Ed. (25) |
| | SR | Beers and Miller. 1973. T & C Enterprises, Manual of Forest Mensuration. (11) |
| a. Measuring trees and logs | SR | Avery, T. E. 1975. Natural Resources Measurements. (7) |
| b. Log grading | TR-SR | U.S.D.A. Forest Service. 1965. A Guide to Hardwood Log Grading. (48) |
| c. Lumber measurements | TR-SR | Smith, Walton R. 1967. Simplified Guidelines to Hardwood Lumber Grading. (39) |
| d. Lumber grading | | |
| (See also exemplary teaching plan in this guide) | | |
| 4. Record Keeping and Inventory | | |
| 5. Tools and Equipment | | |
| a. Measuring tapes, scales, and sticks; markers | | |
| b. Power equipment operation | TR-SR | Owners' Manuals (30) |
| (1) Yard equipment | TR | Small Engines Vol. 1. Care and Operation. AAVIM. (36) |
| (2) Wood processing equipment | | |
| 6. Safety and First Aid | TR-SR | American National Red Cross. 1957. First Aid Textbook. (4) |
| E. Recreation | | |
| 1. Introduction to Recreation | TR-SR | Brockman, F. C., Merriam, L. C., Jr. 1973. Recreational Use of Wild Lands. (15) |
| a. Recreation activities | TR-SR | U.S.D.A. 1967. Outdoors U.S.A. Yearbook of Agriculture. (47) |
| b. Nature interpretation | | |

| Course Outline | Reference Code | Reference |
|---|---|---|
| 2. Rural sociology | TR-SR | Neumeyer, M. H. and Neumeyer, E. S. 1936. Leisure and Recreation. (29) |
| 3. Communication and Transportation Systems | TR-SR | Owners' Manuals (30) |
| a. Radios and phones | | |
| b. Roads | | |
| 4. Building Repair and Maintenance | | |
| a. Carpentry | | |
| b. Painting | | |
| c. Masonary | | |
| 5. Bridges, Trails, Benches, etc.; Construction and Maintenance | | |
| 6. Groundskeeping | TR-SR | Pirone, P. P. 1972. Tree Maintenance. (34) |
| 7. Health and Sanitation | | |
| 8. Safety and First Aid | TR-SR | American National Red Cross. 1957. First Aid Textbook. (4) |
| F. Special Products - Nurseryman | | |
| 1. Tree and Shrub Identification (See exemplary teaching plan in this guide) | TR | Harlow and Harrar. 1968. Textbook of Dendrology, 5th Ed. (22) |
| 2. Plant cultivation and propagation | SR | Mohlenbrock, R. 1973. Forest Trees of Illinois. (27) |
| a. Seedbed preparation, irrigation, and fertilization | TR | Toumey, James W. and Korstian, Clarence F. 1957. Seeding and Planting, 3rd Ed. (44) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| b. Plant insect and disease pests | | |
| c. Plant propagation | TR-SR | Baker, Whiteford L. 1972. Eastern Forest Insects. U.S.D.A. Forest Service Miscellaneous Publication No. 1175. (9) |
| (1) From seed | | |
| (2) From cuttings | TR-SR | Smith, William H. 1970. Tree Pathology. (40) |
| (3) By grafting and budding | TR | Hartmann, H. T. and Kester, D. E. 1975. Plant Propagation, 3rd Ed. (23) |
| 3. Uses for Plants | | |
| a. Forest environment | | |
| b. Urban environment | | |
| 4. Use, Repair, and Maintenance | | |
| a. Hand tools | SR | Owners' Manuals (30) |
| b. Power equipment | TR-SR | Small Engines, Vol. 1-2. AAVIM. (36-37) |
| 5. Building and grounds maintenance | TR-SR | Conover, H. S. 1928. Grounds Maintenance Handbook. Amer. Nurseryman. (18) |
| 6. Safety and First Aid | TR-SR | American National Red Cross. 1957. First Aid Textbook. (4) |
| F. Special Products - Tree Planter | TR | Harlow and Harrar. 1968. Textbook of Dendrology. (22) |
| 1. Tree and Shrub Identification (See exemplary teaching plan in this guide) | SR | Mohlenbrock, R. 1973. Forest Trees of Illinois. Ill. Div. of For. (27) |
| 2. Handling Planting Stock | | |
| a. Cold Storage | TR | Hartman, H. T. and Kester, D. E. 1975. Plant Propagation, 3rd Ed. (23) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| b. Heeling-in | | |
| c. Lining-out | TR-SR | U.S.D.A. Forest Service. 1974. Seeds of Woody Plants. Agr. Handbook No. 450. (49) |
| 3. Planting Procedures | | |
| a. Equipment | | |
| (1) Hand tools | TR-SR | Murphy, R. C. and Meyer, W. E. 1969. Care and Feeding of Trees. (28) |
| (2) Machine planting | TR-SR | Owners' Manuals (30) |
| b. Layout and design | | |
| (1) Site selection | TR | Toumey, James W. and Korstian, Clarence F. 1957. Seeding and Planting, 3rd Ed. (44) |
| (2) Spacing and arrangement | | |
| 4. Principles of Direct Seeding | | |
| 5. Safety and First Aid | TR-SR | American National Red Cross. 1957. First Aid Textbook. (4) |
| F. Special Products - Tree Pruner | | |
| 1. Tools and Equipment, Use and Maintenance | | |
| a. Hand tools | SR | Owners' Manuals (30) |
| b. Power tools | TR-SR | Small Engines, Vol. 1-2. AAVIM. (36-37) |
| c. Ropes and climbing saddles | | |
| 2. Felling and Pruning Techniques | TR-SR | Murphy, R. C. and Meyer, W. E. 1969. Care and Feeding of Trees. (28) |
| a. Removing defective trees | TR-SR | Steffek, Edwin F. 1969. The Pruning Manual. (43) |

| Course Outline | Reference Code | Reference |
|---|---|---|
| b. Pruning branches | TR-SR | Baumgardt, J. P. 1968. How to Prune. (10)<br>A.C. 1963. Fundamentals of Logging, 5th Ed. Allis-Chalmers Mfg. (3) |
| 3. Tree Growth Habits | TR-SR | Frenska, Richard R. 1959. Tree Experts Manual. (20) |
| 4. Safety and First Aid | TR-SR | American National Red Cross. 1957. First Aid Textbook. (4) |

EXEMPLARY TEACHING PLANS

VII. Forestry

A. Forests

2. Identifying Forest Trees and Shrubs

TEACHING PLAN

I. INTRODUCTION: The ability to identify forest trees by common name is essential to the forest worker in carrying out many of his routine responsibilities. Some trees are extremely valuable, others only moderately so, and others, at least in some situations, are weed trees. The forestry worker must be able to identify by common name the trees, especially the commercially important species of his area, by the trees' physical features both in summer and in winter. He must be able to identify trees of all sizes: seedling, sapling, poletimber, and mature sawtimber. For logging, cordwood, and sawmill workers the ability to identify logs and wood is equally important.

II. STUDENT PERFORMANCE OBJECTIVES:

A. Given examples of the commercially important forest trees in the area, the student will be able to identify them by common name, knowing the name of fifty of them from memory and being able to use a tree identification key to determine the names of the others.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. Identifying Trees
   1. By leaf characteristics
      a. Leaf size and shape
      b. Simple or compound form
      c. Leaf arrangement
      d. Leaf margin, pubescence, and color
   2. By twig characteristics
      a. Bud shape and size and color
      b. Pith characteristics
      c. Leaf scars and vascular bundle scars

d. Color
e. Twig growth form

3. By overall crown form and trunk shape (in forest situation)
4. By fruits
   a. Nuts
   b. Cones
   c. Winged fruits
   d. Berries
   e. Other
   f. Season of mature fruiting
5. By flower
   a. Color
   b. Size and form
   c. Season of flowering
6. By bark
   a. Color
   b. Pattern
   c. Texture
7. By taste or smell of twigs or bark
8. By soil or site conditions

B. Identifying logs
   1. By bark
   2. By color of wood
   3. By pattern of growth rings
   4. By taste or smell
   5. Other

C. Identifying lumber or wood
   1. By grain
   2. By hardness
   3. By color
   4. By odor

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Field study, using tree identification keys to identify all the trees in an assigned wooded area.

B. Make a collection of leaves (summer) and twigs (winter) and fruit and identify each with the correct common name.

C. Visit an arboretum or a park. Some parks have specimen trees identified by plaques or signs. Watch for exotic species!

D. Visit a logging area to observe differences in logs of various species.

E. After a determined period of instruction and study, have a tree identification contest among the students in the class.

F. Identify all trees on the school lawn or in a certain area of the town, park, etc., with an appropriate label, tag, or sign as a community service project!

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Specimens of leaves, twigs, fruits, and wood of forest trees common to the area.

B. Slides and pictures of trees, especially close-ups to show identifying characteristics. Kodachrome 35mm slides are best.

C. Pocket knife

D. Hand lens

VI. STUDENT REFERENCES:

A. Identification keys for common trees

B. USDA Yearbook, Trees

C. Ag. Handbook 271

D. Identification of Forest Trees of North America

E. Textbook of Dendrology, Fifth Edition, Harlow & Harrar, McGraw-Hill Pub.

VII. TEACHER REFERENCES:

A. See above references

B. Sargent's Manual of Trees of North America, Two volumes, Dover Pub.

C. Forest Trees of Illinois, Mohlenbrook, Div. of Forestry-Dept. of Conservation, State of Illinois

VII. Forestry

A. Forests

3c(5) and 3e(3)(c). Measuring, Identifying, and Describing Land Areas

TEACHING PLAN

I. INTRODUCTION: The forestry worker must be able to take appropriate and accurate measurements and calculate area for such purposes as determining area forested, harvested, burned, etc.; to measure sample plots for cruising purposes; to establish or relocate boundaries; and to determine ownership. He also needs to be able to describe land location, within the established systems of public land survey.

II. STUDENT PERFORMANCE OBJECTIVES:

A. Given an area to be measured, the intended purpose of the measurement, the degree of accuracy needed, and the available equipment and labor, the student will be able to select an appropriate measuring system from among: pacing, land measuring wheel, taping and compass, or aerial photography and planimetry, justifying his selection to the satisfaction of the instructor.

B. Given a steel tape, range poles, and a set of chaining pins, a team of students can measure an indicated distance to an accuracy of 0.2 foot per 100 feet of distance.

C. Given a steel tape, a set of chaining pins, and a table of sines; a team of students can measure an existing angle and determine its size in degrees with an accuracy to within five minutes of the measurement as determined with a good quality transit.

D. Given a steel tape and a set of marking pins, a team of students will demonstrate its ability to lay off a right angle from a designated base line and be able to explain the mathematical concept employed in the process.

E. Given the legal description of a forest area, the student will be able to sketch a map to show the location of that land in relation to certain fixed markers, boundaries, or permanently located surveyer's references.

F. Given a rectangular, triangular, or irregular shaped area, the student will select appropriate measurements to take and, using those measurements, perform the necessary calculations to determine land area to the degree of precision warranted by the situation.

G. The student should also be able to determine percent and/or degree of slope and to run an accurate compass line about a closed course.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. Some methods and procedures for measuring horizontal distance
   1. Pacing
      a. One man
      b. No equipment needed (except a set distance course for practice)
      c. Accurate enough for many situations
      d. Using a natural pace (= two steps)
      e. Assuming a three-foot step
   2. Using the steel tape
      a. Uncoiling the tape
      b. Reading the tape
      c. Using the tape
         (1) Duties of head tapers
         (2) Duties of rear tapers
      d. Using the marking pins
   3. The land measuring wheel
      a. Advantages - one man
      b. Disadvantages - relative accuracy, especially on rough terrain

B. Measuring existing angles with steel tape
   1. Sine or chord method
   2. Tangent method

C. Laying out right angles with a tape
   1. Sides in ratio 3-4-5
   2. From a point on a given or selected base line, lay out a perpendicular line

D. Determining area
   1. Rectangle
   2. Triangle
   3. Irregular with one straight side
   4. Irregular
   5. Curved boundaries

E. Legal description of forest lands
   1. Metes and bounds
   2. The Northwest Ordinance rectilinear system
      a. Principal meridian
      b. Base line

c. Township and designation
d. Section and designation
e. Subdivision of a section
f. Proper maintenance of equipment

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Field exercise in measuring distance by pacing; the land measuring wheel; and a surveyor's tape and marking pins. Compare the relative accuracy of pacing and the measuring wheel with that of the tape.

B. Measure existing angles with a steel tape and use a trigonometry table to find the angle.

C. Use of compasses, range-finders, and Abney level for slope determination.

D. Measure various shaped land areas and calculate the acreage.

E. Use planimeter to measure areas on aerial photographs.

F. Visit the local ASCS office for an explanation and demonstration of the use of aerial photographs and the planimeter.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Steel tape and marking pins for each three to five students.

B. A land measuring wheel (one for demonstration or for rotational use).

C. Planimeter

D. Other

VI. STUDENT REFERENCES:

A. V.A.S. Unit 3010, Farm Surveying

B. Table of sines

C. V.A.S. Filmstrip 436, Using the Steel Tape in Surveying

D. County plot book

E. Aerial photographs from ASCS

F. Any of several basic surveying or forestry measurement texts

VII. TEACHER REFERENCES:

A. See references above.

VII. Forestry

C. Logging

1 and 2. Felling, Limbing, and Bucking Trees

TEACHING PLAN

I. INTRODUCTION: After a tree has been designated for harvest, it must be felled, limbed, and bucked. The operation must be performed to insure safety to the workers; to cause minimum damage to the equipment, to the tree being felled and to the nearby desirable trees, or other objects which will remain after the felling operation; and to efficiently utilize time and effort.

II. STUDENT PERFORMANCE OBJECTIVES:

A. Given a designated tree to be felled, the student will evaluate the existing conditons and select an appropriate location to fell the tree. He will then be able to explain and justify his choice to the satisfaction of the instructor or to an experienced logger.

B. Once a felling site has been selected, the student will be able to make appropriate site preparations for the felling operation and be able to justify to the instructor or an experienced logger each aspect of the preparation on the basis of safety of operator, possible damage to equipment and site factors, or efficiency.

C. Know how to select proper equipment for felling.

D. Given a tree to be felled; a designated and prepared felling site; a chain saw, axe, wedges, and a sledge or maul, the student will make the appropriate undercut and back-cut (using the wedges, if necessary) to fell the tree in the selected area.

E. Given a felled tree and a chain saw, the student will be able: to evaluate the order of limbing to provide for safety and to reduce obstacles; and to make appropriate cuts flush with the log to remove the limbs from the desired log.

F. Given a felled tree, a chain saw, and a desired length of log or bole, the student will determine a correct

position to handle the saw, and make appropriate cuts (using the axe, wedges, and sledge, when necessary) to produce straight cuts and logs of the desired length.

G. Know how to handle lodged and/or leaning trees and be able to compensate for wind, slope factors, etc.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. Determining where to fell a tree
   1. Observe existing conditions
      a. Lean of tree
      b. Shape and size of the crown
      c. Wind direction and velocity
      d. Nearby obstacles
      e. The terrain
   2. Consider safety for operator and the equipment
   3. Consider possible damage to nearby trees and other objects
   4. Consider succeeding operations of limbing, bucking, and skidding
   5. Consider efficiency

B. Felling the tree
   1. The undercut
      a. [illegible] - to help direct felling to prevent splitting
      b. Where - on side toward which it is intended that the tree will fall
      c. How - horizontal and angular cuts
      d. Position of the saw and the logger
   2. The back-cut
      a. The position of the saw and the logger
      b. The height and distance from the undercut
      c. The use of wedges, the sledge, and an axe
         (1) To tip tree toward desired felling site
         (2) To prevent binding of saw
   3. Dislodging lodged tree
      a. Appropriate use of skidding power equipment
      b. Safety for equipment and logging crew
      c. Protecting other trees

C. Limbing the felled tree
   1. Determining where, in what order, and how to make the cuts
      a. Consider obstacles
      b. Consider safety
      c. Consider desired finished product, and flush cut log or bole
   2. Assume appropriate position and make the determined cuts

D. Bucking the felled tree
   1. Know bole length and determine the desired length of each log
   2. Observe defects that may need to be removed or which will influence the bucking
   3. Determining the type(s) of cuts necessary and the appropriate position of the saw and the logger
   4. Using wedges, sledge, and axe, if necessary
   5. Making straight cuts, perpendicular to the length of the log

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Visit a logging site and have an experienced logger explain and demonstrate the logging techniques of felling, limbing, and bucking, including safety, efficiency, and approved practice of equipment utilization.

B. Under supervision of an experienced instructor, supervisor or logger, each student should fell a number of trees; limb the trees and buck the logs to a designated length.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Chain saws

B. Wedges

C. Sledge

D. Axes

E. Hard hats

F. Measuring equipment

VI. STUDENT REFERENCES:

A. Hilterbrand, An Introduction to Forestry

B. Anyone of several texts or manuals on harvesting forest crops.

C. Allis-Chalmers, Fundamentals of Logging

VII. TEACHER REFERENCES:

A. See references above

VII. Forestry

C. Logging

3a. Understanding the Principle of Operation of Internal Combustion Engines

TEACHING PLAN

I. INTRODUCTION: Modern forestry practices include the utilization of internal combustion engines of various sizes and types. The forestry worker must know the basic principle of operation of these engines to understand their use, adaptability, maintenance, and limitation, so that the engine will be utilized in a manner to promote efficiency, economy, and safety.

II. STUDENT PERFORMANCE OBJECTIVES:

A. Given an engine and/or its component parts and a list of basic engine components such as spark plug, piston, air cleaner, carburetor, distributor, crankshaft, radiator, and fuel injector, the student can correctly identify the part of component which corresponds to the parts named on the list

B. Given the actual engine part or a well constructed model or diagram, the student can give the correct name for those parts designated by the instructor and also describe or explain the purpose of function of that part toward the operation of the engine.

C. Given an internal combustion engine, the student will correctly identify it as a diesel or gasoline type and be able to adequately justify to the instructor the basis for his identification.

D. Given a diagram of four in-line cylinders, a student will be able to diagram in order the four strokes of a 4-stroke cycle engine, showing piston movement, valve position and the name of the respective strokes.

E. Given a diagram or model of a 2-stroke cycle engine, the student will be able to explain how the 2-stroke cycle engine accomplishes the intake, compression, power, exhaust sequence in only two strokes.

F. Given an understanding of the design and principle

of operation of a 2-stroke cycle engine, and the operating circumstance of a chain saw, the student will be able to explain why the two-stroke cycle engine is used in chain saws.

G Given gasoline engines to refuel, the student will be able to justify and explain the addition of lubricating oil to the gasoline of the two-stroke cycle engine and lack of lubricating oil in the gasoline of the four-stroke cycle engine.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. Identifying basic parts of internal combustion engine: piston, cylinder, piston rod, crankshaft, spark plug, crankcase, head, valves, cams, cam shaft, etc.

B. The function of the various parts

C. The four-stroke cycle engine
1. Intake--intake valve open, piston moving down, fuel mixture enters
2. Compression--both valves closed, piston moving up, fuel mixture compressed, ignition near end of stroke
3. Power--both valves closed, piston forced down, burning fuel produces heat, heat results in pressure
4. Exhaust--exhaust valve open, piston moving up, piston drives out burned gases

D The two-stroke cycle engine
1. Power--burning fuel produces heat, heat results in pressure, pressure forces piston down; at bottom of stroke, ports are opened releasing exhaust and a new change of fuel-air mixture enters
2. Compression--as piston begins to move up, ports are closed, and fuel is compressed, ignition occurs near top of stroke

E. Similarities and differences between gasoline and diesel engines
1. Methods of ignition
2. Compression ratios
3. Parts that are the same except for relative strength
4. Distinguishing physical features
5. Adaptability, advantages, and disadvantages

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Study models or cut-aways of engines to learn the special relationship of the various parts.

B. Use audio-visual aids such as animated moving-picture films which show and explain the information to be taught in this unit.

C. Using a discarded engine, make a cut-away model to expose the principal working parts.

D. Use discarded parts from a repair shop as visuals for students to identify by name and function.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Cut-away engine

B. Models of engines

C. Parts of engines

VI. STUDENT REFERENCES:

A. V.A.S. Unit 3014, Small Engines--Principles of Operation, Trouble Shooting, and Tune-up

B. V.A.S. Unit 3020, The Two-cycle Engine

VII. TEACHER REFERENCES:

A. Small Engines, (Vol. 1) Care and Operation, AAVIM

B. Small Engines, (Vol. 2) Maintenance and Repair, AAVIM

C. Small Gasoline Engines, Hobar Publications

VII. Forestry

C. Logging

1 and 2. Servicing and Maintaining the Internal Combustion Engine

TEACHING PLAN

I. INTRODUCTION: Internal combustion engines are utilized to provide power for many modern forestry practices. For the engines to perform as intended; for efficiency, economy, safety and long engine life; recommended maintenance procedures must be followed.

II. STUDENT PERFORMANCE OBJECTIVES:

A. Given a gasoline or diesel engine, the student should be able to: make pre-operation checks of the fuel, cooling and lubricating systems; decide if additions are needed; and to add the proper materials, referring to an operator's manual, if necessary, to determine proper grade, weight, mixture, etc.

B. Given an internal combustion engine, an accompanying operator's manual, and a source of maintenance materials and supplies, the student will be able to determine the manufacturer's recommended interval of performing such maintenance operations as changing the crank case oil, changing the oil filter, cleaning or replacing the air cleaner, cleaning or replacing the fuel filter(s), servicing the battery, and at the appropriate time perform the indicated operations to the specifications given in the operator's manual.

C. Given the task of servicing an internal combustion engine, the student will know the hazards of handling engine fuels, of operating engines inside closed buildings, of handling lead-acid batteries, and other similar hazards and will demonstrate his knowledge of these hazards by using proper safety precautions himself and, when appropriate, instruct others of safety need, violations, or hazards.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. The fuel system
1. Keeping foreign materials out of fuel
2. Servicing the fuel filter

3. Safety in refueling
4. Selecting proper type and grade of fuel
5. Servicing the air cleaner

B. The cooling system
   1. Liquid cooled engine
      a. Checking coolant level
      b. Checking air flow through radiator
      c. Checking fan belt
      d. Checking anti-freeze in winter
      e. Draining, flushing, refilling
   2. Air cooled engines
      a. How heat is dissipated
      b. Reason for fins
      c. Keeping heat radiating surfaces clean

C. The lubricating system
   1. Four-stroke cycle engine
      a. Checking oil level
      b. Selecting oil according to operator's manual or in accordance with approved practices for the type of engine, atmospheric and working conditions
      c. Adding oil
      d. Changing oil
      e. Changing oil filter
      f. Special lubrication such as generator, starter motor, etc.
   2. The two-stroke cycle engine
      a. Determining correct oil-fuel ratio
      b. Determining the correct grade of oil
      c. Keeping fuel clean
      d. Servicing and/or replacing fuel and air filter

D. The electrical system
   1. The battery
      a. Checking the battery electrolyte level
      b. Testing the electrolyte for charge-level
      c. Adding water to the battery
      d. Cleaning battery terminals
      e. Charging batteries
      f. Using jumper cables
   2. The generator
      a. Checking and adjusting the generator belt
      b. Observing and interpreting the ammeter reading
   3. Electrical ignition
      a. Cleaning and inspecting spark plugs
      b. Need to keep distributor and spark plugs free of oil, grease, water, etc.

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Each student brings an internal combustion engine (tractor, lawn-mower, chain saw, etc.) and the

respective operator's manual to the agricultural mechanics shop. From the manual determine the manufacturers recommendations for maintenance of the fuel, cooling, lubricating, and electrical systems. Obtain parts, materials, and supplies needed and perform the maintenance operations which are needed. Since some students will have brought four-stroke cycle, water cooled engines and other may have two-stroke cycle, air cooled engines, after the maintenance operations are completed, the students can demonstrate their knowledge of "how and why" and at the same time instruct others in the class, by giving an oral report to the class of the maintenance procedures.

B. As a part of the supervised experience program, each student services several engines, including engines of various sizes and types, and records the activities in his Supervised Experience Program Record Book.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Hydrometer

B. Spark plug gap gauge

C. Safety fuel cans

D. Funnel

E. Oil, grease, antifreeze

F. Fuel

VI. STUDENT REFERENCES:

A. V.A.S. Unit 3008, Farm Tractor Tune-up

B. V.A.S. Unit 3014, Small Engines--Principles of Operation, Trouble Shooting, and Tune-up

C. V.A.S. Unit 3024, The Storage Battery

D. V.A.S. Unit 3030, The Engine Cooling System

E. Small Gasoline Engines, Hobar Publications

EXEMPLARY TEACHING PLANS

VII. Forestry

B. Forest Protection

UNIT: 1. Fire Control (See also A-6)

TEACHING PLAN

I. INTRODUCTION: Fire, together with soil and climate, are the most important factors affecting the nature and composition of forest vegetation. Wildfire preceded the advent of man upon this planet. Modern man, however, realizes that the natural resources, both renewable--as are forests--and non-renewable, upon which he depends for his existence, are limited in supply. Fire can destroy vast amounts of forest resources and drastically change local environments for long periods of time. Fire can also be used by man to bring about favorable changes in forest ecosystems. Thus, fire can be a devastating destructive force or a valuable tool to be used to effect specific ecological changes of benefit to man in forest resource management. Public concern with protecting and preserving the environment while simultaneously producing a maximum yield of multiple forest resource benefits has led to an increasing need for developing new methods of fire detection and suppression, a need to better comprehend the behavior of wildfires, and the necessity for understanding how to use prescribed fires as a forest management tool. The student must understand fire effects, fire behavior, and fire control techniques.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Given instruction in forest fire control and use, have an understanding of the basics of fire behavior and a knowledge of fire effects. He will be familiar with fire crew organization, communication systems, and the fire danger rating systems. Most importantly, he will know how to participate as a crew member in actual fire detection, fire suppression, and fire mop-up activities in controlling wildfires in the forest environment.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. Fire History
   1. Fire as a basic element of the universe
   2. Fire and man
   3. The fields of fire control defined
      a. Prevention
      b. Detection
      c. Suppression
      d. Effects
      e. Behavior
      f. Economics
      g. Use

B. Fire in the Forest
   1. Kinds of fire
      a. Surface fires
      b. Crown fires
      c. Ground fires (subterannean)
   2. Fire effects
   3. Fire combustion process
      a. Forest vegetation
         (1) Lethal temperatures
         (2) Resistance and susceptibility
         (3) Types of fire damage
      b. Effects on soil
      c. Effects on forest microclimate
   4. Fire behavior and fire weather
   5. Forest fuels
      a. Ground
      b. Surface
      c. Aerial
   6. Fire danger ratings
      a. Measuring the elements in rating systems
      b. Interpreting and using danger ratings

C. Forest Fire Control
   1. Prevention
      a. Causes of forest fires
      b. Reduction of fire hazards
         (1) Slash disposal
         (2) Firebreaks
         (3) Elimination of fire ignition sources
   2. Detection
      a. Lookout systems
      b. Aerial patrol
      c. Detection equipment use
   3. Suppression
      a. Methods and strategy
         (1) Ground control--crew organization and fire line construction
         (2) Aerial support
         (3) Backfiring techniques and application

(4) Mop-up methods
(5) Safety procedures
b. Communication and transportation systems
c. Tools, equipment, and supplies
(1) Base camp materials
(2) Hand tools
(3) Power tools
d. Assessing fire damage

D. Fire Uses
1. Fire prevention and control
2. Watershed and wildlife management
3. Silvicultural applications
4. Insect and disease control

E. Social Aspects
1. Fire economics
2. Public policy
3. Fire laws

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Visit areas where wildfires have burned in the forest environment, observing damage to vegetation and the site, reviewing suppression methods used on each fire, and discussing how each fire might have been prevented.

B. Visit areas where prescribed burns (management fires) have been utilized to achieve specific objectives. Discuss the procedure used, whether or not the objectives appear to have been met, and the conditions under which prescribed burns may be utilized (weather, vegetation, and public relations.

C. Visit a fire control headquarters. Observe the fire detection system, communication system, and fire control tools and equipment. Discuss fire control organization, fire danger rating systems, and fire damage appraisal principles.

D. Use the fire simulator to practice actions and reactions in a suppression situation.

E. Individually practice using the fire control tools and equipment.

F. Practice as a crew building a fire line, extinguishing spot fires, communications, and safety and first aid procedures.

V. SPECIAL MATERIALS AND EQUIPMENT:

A wide variety of tools and equipment are utilized for fire control. In an emergency, a garment or wet burlap bag may be used to beat out a light fire, a can or bucket to throw soil or water upon a fire, or bare hands to drag fuel away from the fire area. Examples of fire tools and equipment for organized fire control include:

1. Power equipment--chain saw, sprayers, tractors, sandcasters, and bulldozers.
2. Hand tools--fire rake, Pulaski tool, axe, crosscut saw, shovels, flapper, brush-hook, driptorch, broom rake, fusees, and backpack pumps.
3. Personnel equipment--gloves, hardhats, heavy boots, and protective clothing.

Many excellent movies on fire control and use are available. The student may have access for practicing purposes to a fire simulator, power tools, and dispatching equipment at a fire control headquarters.

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B. U.S.D.A., Trees, 1949

C. Petterssen, Meteorology, 1958

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F. U.S.D.A., Climate and Man, 1941

G. American Red Cross, First Aid, 1957

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C. Spurr and Barnes, Forest Ecology, 1973

D. Brown and Davis, Forest Fire, 1973

EXEMPLARY TEACHING PLAN

VII. Forestry

A. Forests

UNIT: 3. Mensuration

TEACHING PLAN

I. INTRODUCTION: Mensuration pertains to forest measurement techniques: measuring tree heights and diameters growth and volumes, locating and establishing sample plots, determining site factors such as slope percent and aspect, and sampling methods. Proper forest management is dependend upon availability of accurate data. Such data provides the foundation for the development of a comprehensive management plan. This teaching plan is also pertinent to portions of other cluster areas, such as Logging, Sawmill Worker, and Cordwood Cutter.

II. STUDENT PERFORMANCE OBJECTIVES:

A. Given information concerning the type of measurements or data needed, the student will be able to select the proper instruments and tools for making accurate measurements of tree size, volume, and growth and inventory stands by various sampling techniques.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

Note: The student should be taught how to use the various mensurational tools and equipment, their accuracy and limitations, and their care and field maintenance simultaneously with type of measurement and purpose in Units A and B, pertaining to forest measurements.

A. Linear Measurements
   1. Land
   2. Diameter
      a. Dbh of stem
      b. Upper stem diameters
      c. Crown diameters

3. Heights
   a. Total Height
   b. Bole height
   c. Merchantable height
   d. Stump height

B. Measurements of volume, growth, and yield
   1. Measurements
      a. Board feet
      b. Cubic feet
      c. Cords
   2. Growth and age determinations

C. Area measurements
   1. Land areas
      a. Maps
      b. Aerial photographs
   2. Tree areas
      a. Basal area (BA)
      b. Crown area

D. Constructing and using data tables and log rules
   1. Stand tables
   2. Yield tables
   3. Volume tables
   4. Stocking tables
   5. Log rules, log scale and tree scale
   6. Site index data
   7. Others

E. Grading forest products
   1. Standing timber
   2. Logs
   3. Lumber

F. Forest Inventory and sampling
   1. Sampling methods
   2. Temporary and fixed plot locations
   3. Variable radius (point sampling) vs. fixed radius plots

V. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. In the laboratory, show the student the tools and equipment used to measure trees. Have the student practice handling such equipment, familiarizing himself with the terminology, mechanism of operation, reading the instruments, recording data, and preparing summary information in tabular or graphic form.

B. Visit a timbered area to practice taking measurements on standing trees. Measurements should include heights, volumes, diameters, growth rates and age determinations. Establish the forest boundaries, determining the area within the stand, and locate sample plot centers. Mark trees for harvest using standard local marking techniques.

C. Visit an area of recent harvesting activity or log storage area (log yard) to have the student practice grading and scaling (measuring) logs by species.

D. Use different methods of cruising and sampling timber in a natural stand to: use different methods of data collection, utilize various types of sample plots, and record data on timber inventory forms.

E. Visit a sawmill to practice measuring and grading lumber, recording information by size, type of product, and species.

F. Visit a firewood or pulpwood operation to become familiar with determining volumes and/or weights of wood in stacks, cords, ricks, green tons, or other standard unit of measurement for the region.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Field instruments
   1. For measuring heights, slopes, and elevations
      Examples: hypsometer, clinometer, Abney level, Biltmore stick, etc.
   2. For measuring diameters and circumferences
      Examples: cruising stick, Dbh (diameter) tapes, colipers, etc.
   3. For measuring volumes
      Examples: cruising stick, volume tables, etc.
   4. For growth and age determination
      Examples: increment bores, steel tapes, site index charts.
   5. For plot establishment and sampling
      Examples: 1/5 acre steel tapes, wedge prisms, stakes, etc.
   6. For plot location and mapping
      Examples: steel tape and chaining pins, Abney level, staff compass or forester's compass, maps, and aerial photographs.
   7. For timber marking
      Examples: paint guns, flagging, marking hammer, or bucket and brush.
   8. For personnel
      Examples: hardhats, snake leggings, boots, and appropriate clothing.

B. Laboratory equipment and supplies (some of these may be used in the field also)

1. Engineering scales, protractors, straight-edge, French Curves, grid paper (graph paper), etc.
2. Tally sheets, timber volume tables, inventory summary sheets, etc.
3. Log and lumber grade specifications
4. Basal area tables, site index tables and charts, log scale and tree scale tables, and price data.

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B. Beers, T. W., and C. J. Miller. 1973. Manual of Forest Mensuration. T & C Enterprises, P. O. Box 2196, West Lafayette, Ind. 47906. 153 pp.

C. Avery, T. E. 1967. Forest Measurements. McGraw-Hill Book Co., Inc., New York. 290 pp. LCCCN:67-11563.'

Many other state and government publications which are available will be of benefit for handling specific topics.

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C. Husch, B., C. I. Miller, and T. W. Beers. 1972. Forest Mensuration. 2nd Ed. The Ronald Press Co., New York. 410 pp. LCCCN:72-178844.

The instructor will find a wide range of additional material, ranging from non-technical to highly-technical, available from the State Forestry Offices, U. S. Forest Service Offices, textbook suppliers and commercial industry sources.

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## SCHOOL FACILITIES, EQUIPMENT AND SUPPLIES

The typical facilities of an agricultural occupations department including classroom, laboratory and shop facilities plus office and storage space, are adequate and appropriate as the indoor teaching facilities for a forestry program.

If a forestry program is added to the curriculum where other programs in agricultural occupations are already being taught, an expansion of the facilities for storing teaching materials, equipment and supplies or a rearrangement to provide greater efficiency of the existing storage facilities may be necessary. Space must be available to store teaching aids such as collections of seeds, nuts, cones, twigs, wood samples and leaf mounts. Library and reference storage space must be increased to accommodate the added materials for the forestry curriculum. Likewise, the instrument and equipment storage areas of the laboratory and the tool and equipment storage area of the shop will have to be expanded or rearranged to provide for the storage of the instruments, tools, and equipment which must be added for the forestry curriculum.

It is assumed that few, if any, schools will own or control all of the facilities and equipment needed to provide experience in all instructional units which are included in this guide. In most instances it will be necessary for the field experiences to be gained through cooperative relationships with other agencies. These cooperative relationships might range from permission for classes to visit forested sites to study, measure, evaluate, and plan forestry practices to the establishment of work stations in forestry agencies, industries and businesses.

Even with much of the field experiences being gained in cooperation with other agencies, some specialized forestry supplies, tools, and equipment should be available at the school. The following are forestry items which are referred to in the core course outlines of this guide:

axe

chain saw

cross cut saw

maul

wedge

fire extinguisher, portable

mattock

grub hoe

planting bar

broom rake

fire rake

flapper

pulaski tool

shovel

hard hats

leggings

first aid kit

snake bite kit

collection of seeds

collection of cones

collection of twigs

specimen of wood by species

hand lenses

compass

measuring tape

measuring wheel

Abney level

log rules

Biltmore stick

increment borer

Hygrometer

anemometer

rain guage

soil moisture guage

stream flow meter

thermometer

polarplanimeter

aerial photographs

pole pruners

pruning loppers

knap sack sprayer

back pack pump

2-way radio

## AUDIO VISUAL SOURCES AND MATERIALS

A. Motion Pictures and Film Strips

Current lists of available motion pictures and film strips may be obtained from:

1. Forest Service, U.S.D.A., Washington, D.C.
2. Department of Conservation, Springfield, Illinois.
3. Benton Ranger Station, Illinois Division of Forestry, Benton, Illinois.
4. Other:
   a. Many private organizations, such as conservation groups, have lists of audio-visual materials on file.
   b. Scientific organizations, technical societies, and trade associations.
   c. Public libraries, university and college audio-visual centers, and foundations.
   d. Commercial forestry companies.

B. Classroom Charts, Transparencies, Slides, Etc.

The instructor should obtain catalogs from biological supply houses, such as Turtex, which list many of these items. Much material may also be obtained on a loan bases from professional foresters, various forestry organizations, and forest industry companies.

## TEACHERS' COMPETENCIES AND TRAINING AVAILABLE

A. Four year programs

Comprehensive forestry programs are offered at two state universities. Completion of the programs earns a Bachelor of Science Degree in Forestry. Both universities also offer a wide range of short courses, evening adult education courses, conferences, symposia and field demonstration tours. Regular university credit courses include several introductory or elective courses in forestry.

1. Southern Illinois University-Carbondale, Department of Forestry. Carbondale, IL 62901.
2. University of Illinois-Urbana, Department of Forestry. Urbana, IL 61801.

B. Other university/college programs

1. Two-year technician program
   Southeastern Illinois Junior College, Harrisburg, IL 62946.
2. Several other four-year colleges and two-year junior colleges offer a limited number of introductory forestry courses or forestry related course work. Contact your local institution for specific current information.

C. Other training available

1. Illinois Technical Forestry Association-ITFA. Membership is open to all persons interested in any aspect of forest management or forest conservation. Dues are less than five dollars per year. Meetings are held at different locations in Illinois four times each year. Many topics are discussed and field tours and demonstrations are included. The meetings provide an excellent opportunity for obtaining information on current topics and trends in forestry pertinent to Illinois and for learning about additional sources of training, information, and general aids of benefit to persons involved in vocational training in forestry.
2. Other organizations
   a. Illinois Christmas Tree Growers Association
      Membership is open to all.
   b. Walnut Council
      Membership is open to all.
   c. Society of American Foresters-SAF
      Membership for professional foresters.
   d. American Forestry Association-AFA
      Membership is open to all.

NOTE: Information concerning any of the items listed under "C" above may be obtained from Dr. Paul L. Roth, Department of Forestry, Southern Illinois University, Carbondale, IL 62901.